

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-3. (Cancelled).

4. (Currently Amended) A method of etching an organic dielectric layer over a substrate, comprising:

placing a hard mask over the organic dielectric layer;

placing a patterned photoresist layer over the hard mask layer;

placing the substrate in an etching chamber;

providing an etchant gas comprising NH_3 into the etching chamber, wherein the NH_3 has a flow rate between 5 sccm to 1500 sccm;

generating a plasma from the NH_3 , which selectively etches the organic dielectric layer with respect to the hardmask; and

simultaneously stripping the photo resist layer during the etching of the organic dielectric layer.

5. (Original) The method, as recited in claim 4, further comprising providing CH_3F while providing the etchant gas comprising NH_3 .

6. (Cancelled).

7. (Currently Amended) The method, as recited in claim [6] 5, further comprising providing an etch with an etchant gas comprising CF₄, prior to the step of providing the etchant gas comprising NH₃.

8. (Original) The method, as recited in claim 7, wherein the etchant gas comprising CF₄, further comprises C₄F₈.

9. (Original) The method, as recited in claim 8, wherein the etchant gas comprising CF₄ further comprises O₂.

10. (Cancelled).

11. (Currently Amended) The method, as recited in claim [10] 4, wherein the organic dielectric layer is made of an organic low-k material, and wherein the simultaneous stripping completely strips the photoresist layer.

12 (Cancelled).

13 (Currently Amended) A method of etching an organic low-k dielectric layer over a substrate, comprising:

placing a hard mask over the organic low-k dielectric layer;

placing a patterned photoresist layer over the hard mask layer;

placing the substrate in an etching chamber;

providing an etchant gas comprising NH₃ into the etching chamber;

generating a plasma from the NH₃, which is able to selectively etch [etches] the organic low-k dielectric layer with respect to the hard mask and strips the photoresist layer:

selectively etching the organic low-k dielectric layer with respect to the hardmask; and

simultaneously stripping the photo resist layer during the selective etching of the organic low-k dielectric layer.

14-19. (Cancelled).

20. (Previously Added) The method, as recited in claim 13, wherein the NH₃ has a flow rate, wherein the flow rate of NH₃ is from about 100 sccm to about 1000 sccm.

21. (Previously Added) The method, as recited in claim 13, wherein the NH₃ has a flow rate from about 300 sccm to about 800 sccm.

22. (Previously Added) The method, as recited in claim 21, further comprising maintaining the substrate at a temperature between about 10° C to about 40° C during etching of the organic dielectric layer.

23. (Cancelled).

24. (Previously Added) A method of etching an organic dielectric layer disposed below a hardmask layer and over a substrate, comprising:

placing the substrate in an etching chamber;

providing an etchant gas comprising NH_3 into the etching chamber with a flow rate from about 300 sccm to about 800 sccm;

generating a plasma from the NH_3 , which etches the organic dielectric layer; and

maintaining the substrate at a temperature between about 10°C to about 40°C during the etching of the organic dielectric layer.

25. (New) The method, as recited in claim 1, further comprising providing a bias power of between about 0 W and 100 W during etching of the organic dielectric layer.

26. (New) The method, as recited in claim 13, further comprising providing a bias power of between about 0 W and 100 W during etching of the organic low-k dielectric layer.

27. (New) The method, as recited in claim 13, further comprising:

placing an etch stop layer over the organic low-k dielectric layer;

placing a second organic low-k dielectric layer over the etch stop layer, wherein the second organic low-k dielectric layer is between the organic low-k dielectric layer and the hardmask

28. (New) The method, as recited in claim 27, further comprising etching the second organic low-k dielectric layer with a first etch, wherein the first etch provides a bias power of between about 250 W to about 2500 W before selectively etching the organic low-k dielectric layer.

29. (New) The method, as recited in claim 28, further comprising providing a bias power of between about 0 W and 100 W during etching of the organic dielectric layer.

30. (New) The method, as recited in claim 29, further comprising providing an etchant gas comprising CF₄ for the etching the second low-k organic dielectric layer.

31. (New) The method, as recited in claim 30, wherein the etchant gas comprising CF₄ further comprises C₄F₈.

32. (New) The method, as recited in claim 31, wherein the etchant gas comprising NH₃ uses NH₃ alone as the etchant.

33. (New) The method, as recited in claim 13, wherein the simultaneous stripping completely strips the photoresist.

34. (New) The method, as recited in claim 13, wherein the etchant gas comprising NH₃ uses NH₃ alone as the etchant.

lines 20-27, of Ding states that this etchant combination is for etching silicon dioxide. Col. 21, lines 43-45, of Ye states that the hardmask disclosed in Ye is silicon oxide. So it would not be obvious to combine the etch chemistry of Ding with the process of Ye to selectively etch an organic dielectric layer with respect to a hardmask, since Ding teaches that such a chemistry etches the hardmask of Ye and fails to teach that such a chemistry selectively etches the organic dielectric layer with respect to the hardmask. Therefore these cited references in combination do not provide a fast etch of the organic dielectric layer that has a high selectivity with respect to the hardmask layer.

In addition, claim 11, as amended, and claim 33 recite that the simultaneous stripping completely strips the photoresist layer. The complete stripping of the photoresist is disclosed on page 13, lines 25-32, of the application. Ye does not teach completely stripping the photoresist simultaneously with etching the organic dielectric layer. Instead, col. 4, lines 5-30, provides an extra step for removing residual photoresist after the organic dielectric has been etched, and therefore does not simultaneously strip all of the photoresist during the organic dielectric layer etch. One of the reasons that Ye does not completely strip the photoresist is that Ye is not able to selectively etch the organic dielectric layer with respect to the hardmask. If the photoresist was completely stripped, the hardmask may be etched away. For at least these reasons, claims 5, 7-9, and 11 are not made obvious by Ye in view of Ding, in view of Ikegami.

Claims 6, 10, and 14-15 have been cancelled.

The Examiner rejected claims 20-24 under 35 U.S.C. 103(a) as being unpatentable over Ye et al. in view of Guinn et al. (US 5,877,032)

Claims 20-22 ultimately depend on claim 13. Guinn does not disclose or suggest parameters that allow the selective etching of the organic dielectric layer with respect to the hardmask. Therefore neither Ye nor Guinn separately or in combination suggest parameters that would provide the desired selective etch. For at least these reasons, claims 20-22 are not made obvious by Ye in view of Guinn.

Claim 23 has been cancelled.

Claim 24 does not specifically recite the selective etch. However, the parameters recited in claim 24 provide the selective etch. Since Ye and Guinn would not provide parameters for a selective etch, Ye and Guinn would not make obvious the adjusting of parameters to obtain the parameters as recited in claim 24.

New claims 25, 26, and 29 recite that the organic dielectric layer etch has a bias of 0 W to 100 W. The low bias provides the unobvious highly selective etching of the organic dielectric layer over the hardmask. This power range is disclosed on page 13, lines 5-6, of the application. Ye in col. 22, lines 15-21, teaches a 400 W bias power.

New claim 27 recites providing an organic second low-k dielectric layer and an etch stop layer. This is shown as layers 14 and 16 in FIG. 2a of the application. This is not disclosed or made obvious by the cited references.

New claim 28 recites providing a bias power of 250 W to about 2500 W during a first etch of the second low-k dielectric layer. This is supported on page 10, lines 24-25, of the application. This is not disclosed or made obvious by the cited references.

New claims 32 and 34 recite that the etchant gas comprising NH₃ uses NH₃ alone as an etchant. This is disclosed on page 13, lines 11-12, of the application. This is not disclosed or made obvious by the cited references.

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at telephone number (831) 655-2300.

Respectfully submitted,

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